Remarks

The paragraph beginning on line 4 of page 3 includes spelling corrections for "compliant" and "and" and an added "open" parenthesis before "wet layup)."

The paragraph beginning on line 18 of page 3 has been amended by deleting the first sentence and by correcting the spelling of "used."

The last sentence of the paragraph beginning on line 14 of page 8 has been deleted.

The amendments to the paragraph beginning on line 23 of page 8 are to change the instances of the word "preforms" into the singular form "preform."

The paragraph beginning on line 16 of page 10 is amended to change the reference to FIGURE "6A" to "9A."

Marked-up copies of the replaced paragraphs are attached.

Version with Markings to Show Changes Made

Paragraph beginning on line 4 of page 3:

The present invention generally uses conventional composite tape, fabric and/or metal details for structural skins, spar and bulkhead webs, fittings et cetera. Conventional laminates are used where high in plane properties are desired. Many different material combinations are possible such as RTM details, thermoplastic details, fiberglass, BMI, etc. The most cost effective process of fabricating the details can be used, in example, a tape laid, platten press cured, waterjet trimmed spar web. The finished details are located with uncured, resin infused 3-D woven connectors (preforms) and adhesive in between the parts in a simple assembly jig or with self locating tooling features (tooling tabs or pins, etc.) Simple [complaint] compliant overpresses are then placed over the weaves. The assembly is then vacuum bagged and cured, typically with heat [an/or] and/or pressure, or E-beam processed to avoid thermal effects. It is also possible to assemble structures with room temperature cure systems (wet layup).

Paragraph beginning on line 18 of page 3:

[The 3-D woven preform advanced weave architectures and resin infusion techniques are described in U.S. Patent Application Serial No. _____ entitled _____, filed _____.] The use of these advanced 3-D woven connectors combined with the co-bond process produces low cost, robust, composite structural joints not obtainable with other prior art. Simple, inexpensive, compliant overpresses can be [sued] used since the uncured 3-D textile connector forms against the cured detail parts during processing. This method avoids the precision tools required for co-cure (where all the parts are uncured) or the precise fit up required with secondary bonding (where multiple cured parts are brought together with a thin layer of adhesive in between).

Paragraph beginning on line 14 of page 8:

In the most general application, structural assembly 10 is formed by coupling at least one sub-assemblies 12 with an uncured pre-form 14 in a curing process. In one embodiment of the present invention, pre-form 14 is a 3-D woven textile impregnated with an uncured resin. Additionally, an adhesive film 16 can be placed between the sub-assemblies 12 and uncured pre-form 14. The adhesive layer can be incorporated into the resin impregnating the 3-D woven textile. However, self-adhering resin systems typically do not have the same properties. [This leads to the adhesive infused pre-form disclosed in U.S. Patent Application _____.]

Paragraph beginning on line 23 of page 8:

Structural assembly 10 is formed when sub-assemblies 12 and pre-form[s] 14 are cured in place. This creates a robust joint between two pre-cured composites or metallic sub-assemblies 12. By simultaneously co-bonding sub-assemblies 12 to pre-form[s] 14, fiber waviness in sub-assemblies 12, which seriously reduces structural strength, can be avoided. Additionally, the process avoids matching a cured composite structure to a cured sub-assembly, which requires expensive tooling and fine tolerances to achieve uniform bondlines that are critical for structural performance.

Paragraph beginning on line 16 of page 10:

To add additional strength to assembly 10, overwrap plies 28, as shown in FIGURE [6A] 9A can be applied on exterior surfaces of the 3-D woven textile preform 14 and sub-assemblies 12 prior to cure 106.

Remarks

Attached are copies of marked-up claims 1 through 43, of which claims 14 and 25 have been canceled. Allowance of the remaining claims is respectfully requested.

Version with Markings to Show Changes Made

1. [AMENDED] A structural assembly comprising:

a first pre-cured assembly; and

a 3-D woven textile pre-form impregnated with an uncured resin and [that is] coupled to said first pre-cured assembly [with a film adhesive], wherein said first pre-cured assembly [assemblies,] and said 3-D woven textile pre-form[, and film adhesive] are cured to form the structural assembly.

2. [AMENDED] The structural assembly of Claim 1 further comprising:

at least one additional assembly wherein said at least one additional assembly is coupled and cured to said first pre-cured assembly and said 3-D woven textile preform [with a film adhesive].

3. The structural assembly of Claim 2, wherein said at least one additional assembly is a metal assembly or a pre-cured assembly.

4. The structural assembly of Claim 2, wherein said first pre-cured assembly and said at least one additional assembly are pre-cured laminated composite structures.

5. The structural assembly of Claim 1, wherein said 3-D woven textile pre-form is impregnated with an uncured resin.

6. [AMENDED] The structural assembly of Claim 2, wherein said first pre-cured assembly [assemblies,] and said 3-D woven textile pre-form[, and film adhesive] are cured in an autoclave with heat and pressure.

7. The structural assembly of Claim 2, where said pressure is applied with a pressure intensifier located proximate to said pre-cured assemblies and said 3-D woven textile pre-form.

8. [AMENDED] The structural assembly of Claim 2, wherein said pre-assemblies[,] and said 3-D woven textile pre-form[, and film adhesive] are cured with a low temperature vacuum bag.

9. [AMENDED] The structural assembly of Claim 2, wherein said pre-assemblies[,] and said 3-D woven textile pre-form[, and film adhesive] are cured with an E-Beam cure resin system.

10. [AMENDED] The structural [structure] assembly of Claim 2, further comprising composite overwrap plies on the exterior surface of said 3-D woven textile pre-form.

11. The structural assembly of Claim 2, wherein said pressure intensifier comprises a flexible material that forces said 3-D woven textile against said first pre-cured assembly and said at least one additional assembly.

12. The structural assembly of Claim 1, wherein said 3-D woven textile further comprises at least one fiber woven through critical intersection zones.

13. [AMENDED] A method of forming a structural assembly [assemblies], comprising the steps of:

affixing [a first adhesive film in between] a first pre-cured assembly to [and] a 3-D woven textile pre-form impregnated with an uncured resin;

affixing [an additional adhesive film between] at least one additional pre-cured assembly to [and] said 3-D woven textile; and

curing said resin [adhesive films] to form the structural assembly.

14. CANCELED

15. The method of Claim 13, wherein said first pre-cured assembly and said at least one additional pre-cured assembly are pre-cured, laminated composite structures.

16. [AMENDED] The method of Claim 13 [14], wherein said step of curing [said adhesive films, said 3-D woven textile pre-form, and film adhesive] is implemented in an autoclave with heat and pressure.

17. [AMENDED] The method of Claim 16, wherein [where] said pressure is applied with a pressure intensifier located proximate to said pre-cured assemblies and said 3-D woven textile pre-form.

18. The method of Claim 16, wherein said step of curing is implemented within a low temperature vacuum bag.

19. The method of Claim 16, wherein said step of curing is implemented with an E-Beam cure resin system.

20. The method of Claim 16, further comprising the step of applying composite overwrap plies on exterior surfaces of said 3-D woven textile pre-form.

21. The method of Claim 17, wherein said pressure intensifier comprises a flexible material that forces said 3-D woven textile against said first pre-cured assembly and said at least one additional pre-cured assembly.

22. The method of Claim 21, wherein said flexible material is rubber.

23. The method of Claim 13, wherein said 3-D woven textile further comprises at least one fiber woven through critical intersection zones.

24. [AMENDED] A method of forming structural assemblies with pre-cured laminated composite structures, comprising the steps of:

affixing a first adhesive film in between a first pre-cured laminated composite structures and a 3-D woven textile pre-form impregnated with an uncured resin;

affixing an additional adhesive film between at least one additional pre-cured laminated composite structures and said 3-D woven textile; and

curing[, with heat and/or pressure,] said adhesive films, said first pre-cured laminated composite structures, said at least one additional pre-cured laminated composite structures and [a] said 3-D woven textile pre-form to form the structural assemblies.

25. CANCELED

26. [AMENDED] The method of Claim 25, where [said] pressure is applied during said curing step with pressure intensifiers located proximate to said pre-cured laminated composite structures[,] and said 3-D woven textile pre-form.

27. The method of Claim 26, wherein said step of curing is implemented with a low temperature vacuum bag.

28. The method Claim 26, wherein said step of curing is implemented with a E-Beam cure resin system.

29. The method of Claim 26, further comprising the step of applying composite overwrap plies on exterior surfaces of said 3-D woven textile pre-form.

30. The method of Claim 26, wherein said pressure intensifier comprises a flexible material that forces said 3-D woven textile pre-form against said first pre-cured laminated composite structures and said at least one additional pre-cured laminated composite structures.

31. The method of Claim 30, wherein said flexible material is rubber.

32. The method of Claim 24, wherein said 3-D woven textile pre-form further comprises at least one fiber woven through critical intersection zones.

33. [NEW] The structural assembly of Claim 1, wherein said 3-D woven textile is Pi-shaped.

34. [NEW] The structural assembly of Claim 1, wherein said 3-D woven textile is T-shaped.

35. [NEW] The structural assembly of Claim 1, wherein said 3-D woven textile is Pi-shaped.

36. [NEW] The structural assembly of Claim 2, wherein a film adhesive is placed between said pre-form and said first pre-cured assembly.

37. [NEW] The structural assembly of Claim 2, wherein a film adhesive is placed between said pre-form and said at leasr one additional assembly.

38. [NEW] The method of Claim 13, wherein said 3-D woven textile is T-shaped.

39. [NEW] The method of Claim 13, wherein said 3-D woven textile is Pi-shaped.

40. [NEW] The method of Claim 13, wherein a film adhesive is placed between said pre-form and said first pre-cured assembly.

41. [NEW] The method of Claim 13, wherein a film adhesive is placed between said pre-form and said at leasr one additional assembly.

42. [NEW] The method of Claim 24, wherein said 3-D woven textile is T-shaped.

43. [NEW] The method of Claim 24, wherein said 3-D woven textile is Pi-shaped.

Put in IDS

Publications before one year prior to filing of the present application:

Robust Composite Sandwich Structures, AIAA-98-1873, 1998

Affordable Composite Structure for Next Generation Fighters, SAMPE, 1998

These 1998 publications do not constitute prior-art disclosures under 102(b) because they are not enabling, lacking details necessary for implementation of the present invention.

Publications within one year prior to filing:

Composite Structures: Theory and Practice, ASTM STP 1383, 2000

Primary Sandwich Structures: A Unitized Approach, AIAA-2000-1430, 2000

Interlaminar Reinforced Composites: Development for Improved Damage Tolerance, AIAA, 2000

Presentations within one year prior to filing::

Affordable 3D Integrated Composite Structures, presented at Defense Manufacturing Conference 2000, November 27-30, 2000

Please charge any additional required payment of fees for prosecution of the above-identified application to Deposit Account No. 50-0259.

Respectfully submitted,

Date: 8/29/01

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